

General Articles

The School Nurse's Role in Prevention of Student Use of Performance-Enhancing Supplements

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ABSTRACT: *An alarming trend in the United States is the use of performance-enhancing supplements by children and adolescents. These widely available over-the-counter products, often marketed as natural substances, are not regulated by the Food and Drug Administration and are thus widely available. High school and even middle school students are using these supplements because they are misled into thinking that supplements will enhance their athletic skills resulting in an improvement in their performance. Yet, the safety and long-term effects of these supplements have not been established in reputable or prevalent studies. School nurses have a unique opportunity and even an ethical responsibility to help in efforts to address this growing trend. Specific roles for the school nurse include serving as a student advocate for the health and safety of children and adolescents; identifying at-risk students; forming partnerships with teachers, parents, students, coaches, athletic trainers, and local health care providers; evaluating and refining health-oriented curricula; collecting and disseminating new knowledge; and staying abreast of new findings. (J Sch Health. 2006;76(5):159-163)*

The use of performance-enhancing supplements has become a growing concern in our country. Of special interest is the fact that many adolescents are drawn to the use of such supplements. Some adolescents use the supplement in order to excel as athletes, while other adolescents strive to combat obesity through resistance training. Seeing limited results, they are drawn to supplement use to enhance the development of their physiques. In either case, adolescents are looking for an easy way to achieve their dreams of being fit.

Currently, many of the role models for athletes are being accused of using supplements to enhance their performance. It has become of such concern that congressional hearings are now being conducted to address this potential epidemic. The sport of baseball is reeling from the accusations. Many student athletes have aspirations, realistic and unrealistic, of playing sports in college and even professionally. They strive to have an edge on their competitors. Developmentally, they are in a period of egocentrism in which they think that they are special and are free from harm. These students are at risk of following in the shoes of some of their role models as they seek supplements to enhance their skills.

A second area of concern is related to the decline in physical fitness and the rising number of obese and overweight children and adolescents. Obesity rates in children have been reported as 27% for boys and 10.3% for girls.¹ Rates are higher among Mexican/American males (15-28%), African/American males (11-29%), and Mexican/American girls (15-28%).² To address this serious issue,

both the Healthy People 2010 and the Dietary Guidelines for Americans have objectives that recommend an increase in daily physical activities for these age groups.³ As new initiatives and programs have emerged, resistance training, also known as strength training, has become a popular and important part of many sports and fitness programs designed for children and adolescents. Resistance training includes the use of free weights, weight machines, elastic tubing, or even body weight to perform resistance exercises. As these adolescents pursue resistance training, they too are confronted with the temptation to seek supplements to enhance their results.

REVIEW OF LITERATURE

Physical activity rapidly declines during childhood and adolescence. Resistance training for children and adolescents is an appropriate and effective method for encouraging more activity. The American Academy of Pediatrics concludes that when properly structured with regard to frequency, type of lifting, intensity, and duration of the program, resistance training can increase strength in pre-adolescents and adolescents.⁴

Large muscle mass and bulkiness will not be a reality for most children and adolescents participating in resistance exercise. Every individual has genetic characteristics that affect strength development and body shape. Males will respond differently than females due to hormonal differences.⁵ In most preadolescents, proper resistance training will usually enhance strength without resulting muscle hypertrophy. Thus, individual progress and self-improvement must be the principles that are taught and rewarded in these programs.⁶

An alarming trend accompanying preadolescent and adolescent participation in strength training programs is an increase in the use of anabolic steroids and over-the-counter supplements such as androstenedione, creatine, and ephedrine. The over-the-counter supplements are marketed

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as muscle builders, with claims to help improve strength and stamina. High school and middle school students are using these supplements as aides to improve their skills, gain an edge on the competition, or help them become more athletic.⁷ The risks of anabolic steroid use have been well documented.^{8,9,10,11} However, there is little information on the risks or benefits of the over-the-counter supplements used by children and adolescents. The use of such products may result in acute and chronic health consequences for this population.

Anabolic-Androgenic Steroids

Anabolic-androgenic steroids (AAS) are synthetic derivatives of testosterone used to increase lean body mass and improve strength and performance.¹² In order to obtain AAS, one must have a prescription. AAS have been found to have a number of side effects (Table 1). Adverse effects have been associated with the increase in serum androgens. In a study of 58 men who were past and present AAS users, a number of adverse effects were reported. These included liver damage, gynecomastia, reduced sperm production, testicular atrophy, mood changes, and changes in libido.⁸ These men stated that they would continue use of AAS, despite the occurrence of adverse effects. For females, effects could include a disrupted menstrual cycle, a deepened voice, hirsutism, enlarged clitoris, masculinization, and kidney and liver damage. Possible premature closure of the epiphyseal plates could result in stunted growth. Severe acne may also occur.

As a result of the difficulty in obtaining AAS and the numerous side effects, people have begun to look for more natural substances to get the same effect. Steroid precursors have become one of the more frequently sought-after supplement.

Steroid Precursors

Steroid precursors are actually steroids; yet, they have not been classified as anabolic or controlled substances by the Department of Drug Enforcement or the Food and Drug Administration.¹² Thus, they can be fairly easily ob-

tained. In addition, there is much controversy regarding the side effects that result from the use of steroid precursors. Steroid precursors include androstenedione, androstenediol, and dehydroepiandrosterone. These are natural hormones produced by the gonads, adrenal glands, or by peripheral transformation and serve as an immediate precursor to testosterone and estrogen. These supplements are sold in health food stores and are marketed as a product that increases blood testosterone concentrations for the purposes of increased strength, lean mass, and sexual performance.¹³ There has been conflicting evidence in the media concerning the effects of these substances, resulting in confusion for the adolescent user.

A double-blind randomized trial conducted by King et al⁹ reported no increased levels of testosterone in normal testosterone-producing male subjects who used the supplement, androstenedione. No change in serum-free or total testosterone level was observed in an 8-week period. The study by King et al also reported significantly lowered serum concentrations of high-density lipoprotein cholesterol (HDL) in the subjects. Reduced HDL is associated with an increased risk of cardiovascular disease (Table 1). Use of this supplement by children and adolescents should be avoided until further investigation supports the safety as well as the efficacy of the supplement.¹⁴

Creatine

There are no reputable studies or other such sources that support the use of creatine use for children and adolescents. Studies by Metzl et al¹⁵ and the National Institute on Drug Abuse¹⁰ indicate however that there is an increase in its use in these age groups. Use increased from 1.7% in 2000 to 2.4% in 2001. Creatine use was reported in grades 6 through 12. Use was more common among boys than girls. The most significant use was reported among football players, wrestlers, hockey players, gymnasts, and lacrosse players, though athletes in every sport reported use. Enhanced performance and improved appearance were the most cited reasons for taking creatine. The prevalence of use in grades 11 and 12 has approached levels reported among collegiate athletes.¹⁵

Table 1
Commonly Used Supplements and Their Adverse Effects

Supplement	Adverse Effects
Anabolic steroids	Males: kidney damage, liver damage, premature baldness, gynecomastia, enlarged prostate, reduced sperm production, testicular atrophy, heightened aggression, severe acne, premature closure of epiphyseal plates Females: disrupted menstrual cycle, breast shrinkage, receding hair line, deepened voice, hirsutism, enlarged clitoris, masculinization, kidney damage, liver damage, severe acne, premature closure of the epiphyseal plates
Androstenedione	Males: same as anabolic steroids Females: Breast cancer, pancreatic cancer, increased risk of cardiovascular disease, hepatotoxicity
Creatine	Increased muscle cramping, nausea, appetite loss, diarrhea, weight gain, muscle strains, dehydration, seizures, elevated liver transaminase, acute renal injury
Ephedrine	Hypertension, dizziness, headache, gastrointestinal distress, irregular heartbeat, restlessness, insomnia, psychosis, memory loss, muscle injury, heart attack, stroke, seizures, death

Creatine supplementation is advertised as a muscular performance enhancer. These claims are supported by scientific evidence, but their potential seems to have been inflated.¹⁶ Creatine is a substance that is normally present in human muscle and comes from dietary sources such as animal flesh and is manufactured by the liver and kidneys from amino acids. It is eliminated from the body by the kidneys either as creatine or as creatinine, a product that results from the metabolism of creatine. It is not clearly understood how it works.¹⁶ Op'Teijnde and Hespel¹¹ conducted a study of 11 healthy young male volunteers and concluded that short-term creatine supplementation does not alter the responses of growth hormone, testosterone, and cortisol in a single bout of heavy resistance training.

Short-term exercise studies of less than 2 weeks have not reported adverse events associated with creatine supplementation. However, there are no studies greater than 12 weeks' duration that evaluate the safety of prolonged use. It is important to reiterate that no studies have been performed to establish short- or long-term effects of use in children and adolescents. The Food and Drug Administration does not regulate creatine, and there are no published studies to determine what impurities may be present in the supplements and what their effects may be.¹⁶ Some reports have suggested that creatine can be linked to muscle cramping, nausea, other gastrointestinal disturbances, acute renal injury, and an increased liver transaminase (Table 1). Potential long-term effects may lead to liver damage, kidney stones, and dehydration.¹⁶

Ephedrine

Ephedrine is used in supplements like Metabolite marketed to suppress the appetite, provide energy, increase lean muscle mass, and enhance fat burning. These supplements frequently contain caffeine and aspirin in addition to the ephedrine. Ephedrine is a central nervous system stimulant and decongestant that is structurally similar to amphetamines. Combinations of ephedrine and caffeine are synergistic, thereby substantially increasing the side effects of each compound to a greater degree than if only 1 of the compounds was used. As described in Table 1, side effects include hypertension, tachycardia, dizziness, headache, gastrointestinal distress, irregular heartbeat, stroke, seizure, or death. Ephedrine can be extracted from herbs such as *ma huang* and *Sida cordifolia* (country malow). As a result, adolescents may use these supplements without realizing that they are linked to ephedrine.¹⁷

In order to address the problems related to supplement use, society must become better informed. This may occur through programs focused on education, identification, and collaboration.

PREVENTION PROGRAMS

Educational programs regarding anabolic steroid and other supplement use are important in order to accurately inform adolescents and those involved with adolescents about potential risks. These programs should be provided by those with expertise in working with adolescents and supplement use. Scare tactics should be avoided since they do not work well in the adolescent population and may actually create a credibility issue.¹⁸

Athletes Training and Learning to Avoid Steroids is 1 example of a health education program that has been used successfully.¹⁹⁻²¹ The program targets male adolescent athletes and focuses on avoiding the use of anabolic steroids and other performance-enhancing supplements, as well as alcohol and other drugs, while stressing healthy nutrition and exercise practices. The program uses a team-centered approach and addresses the causes and risks of substance abuse that are unique to male adolescents. Peer instructors and a coach facilitator use a scripted program to address the topics.^{20,21} The effectiveness of the program was evaluated by a randomized control trial conducted 1 year after program intervention. The results revealed a 50% reduction in new use of anabolic steroids and performance-enhancing supplement use and improved substance abuse protective factors such as enhanced nutrition behaviors, athletic self-efficacy, and perception of athletic competence.¹⁹ A similar program geared to female middle and high school students is currently being evaluated. This program is known as ATHENA or Athletes Targeting Healthy Exercise and Nutrition Alternatives.²² Results of ATHENA suggest that high school athletes from this program used significantly fewer diet pills and athletic-enhancing substances than the students who received only a questionnaire. Furthermore, the students were better able to turn down drug offers, participate in healthier activities, and improve their dietary intake.²²

In Sweden, an appearance program was developed to combat the misuse of steroids by adolescents.²³ Youth leaders and health care workers provided the program over a 2-year period. The purpose of the program was to raise the self-confidence of adolescents and increase their awareness of appearance ideals. The program consisted of 12 lectures, group discussions, brochures, posters, and trailers. The program was offered in schools and community sites such as gyms. Ninety-five percent of the men came to realize that many women were not attracted to large muscles. Seventy-seven percent came to disapprove of steroid use.

THE ROLE OF THE SCHOOL NURSE

School nurses are in a unique position to address the growing trend of performance-enhancing supplement use among children and adolescents. Identification of at-risk populations, knowledge regarding signs and symptoms of use, and partnerships that provide guidance and health education for students, parents, and other school personnel are important roles of the school nurse.²⁴

Identify At-Risk Students

School nurses are in an ideal position to identify students at risk for supplement use. The sports physical examination can be an opportune time to assess students for supplement use. Thorough history taking may reveal specific indicators of use such as hypertension, tachycardia at rest, sudden increase in weight, the presence of severe acne, vocal changes such as unusual deepening of the voice, proteinuria, and other urinalysis abnormalities. The school nurse may conduct a follow-up visit in order to open a dialogue and reassess blood pressures, urine, and other tests. Gentle probing with nonjudgmental questions may help ascertain supplement use. Specific questions should address medication and supplement use, physical activity, changes in mood (restlessness, aggression, memory

decrease, and difficulty sleeping), and physical symptoms (headache, gastrointestinal distress, change in hair, muscle cramps, nausea and vomiting, decreased appetite, diarrhea, and breast changes) (Table 1).

Form Partnerships

The school nurse may want to form partnerships with teachers, parents, students, coaches, athletic trainers, and local health care providers. These partnerships can be vital in identifying at-risk adolescents, providing information, decreasing the pressures to use supplements, and developing programs to combat this growing problem.

Since parents, students, and teachers see students on a regular basis, they may be especially helpful in identifying students who are using supplements. The school nurse can initiate educational sessions regarding the signs and symptoms of supplement use to facilitate identification of adolescents who are potential users. Specific emphasis should be placed on the easy access adolescents have to over-the-counter performance enhancers and the fact that little is known regarding their safety. Thus, many parents may not be aware that their child is using the supplements. Some parents and peers may actually encourage supplement use, thinking that it will enhance the child's athletic performance without causing harm. It is important that parents and teachers as well as students have accurate information regarding supplement use. The school nurse may want to provide in-services and brochures through organizations such as the Parent-Teachers Association in order to increase the awareness of the potential dangers associated with supplement use as well as indicators that a child may be using them.

The school nurse may find it beneficial to review the existing health education curricula used by teachers assessing it for current information, format of presentation, grade levels, and courses in which the information is presented. Specifically, the school nurse may want to assess whether information regarding performance-enhancing supplementation is included. If it is not, the school nurse may work with teachers and administrators to add the needed content to existing curriculum or to assist in evaluating a new curriculum that provides this information.

The school nurse may want to elicit the participation of representatives from local agencies such as hospitals, clinics, and private gyms to increase community awareness of the issue and to gather support for initiatives to curtail use. The school nurse may use experts from the community as guest speakers in order to provide credibility.

Coaches have a stake in the athletic performance of their players. Some may send ambiguous messages to students—"don't use drugs, but be bigger, stronger and faster." Most will agree that 1 of their primary goals is to have a winning team. Supporting a coach's efforts to establish or continue an appropriate, supervised resistance training exercise program for athletes may show the school nurse's support for reaching this goal and will help provide additional health education opportunities with the teams. The school nurse may be able to work with teams in developing healthy ways for improving their performance. They may want to encourage supervised resistance training programs while stressing individual participant's differences and goals in such programs.

In many school systems, athletics are a major source of income for middle and high schools. Winning teams generally generate more money. It is important to have winning teams; hence, a "hands-off" attitude may prevail in regard to training and practice protocols. However, administrators may not be aware of the growing trend of supplement use and availability and safety considerations. Local and state school medication administration policies and law including student possession of such may also be a consideration and concern. It may be necessary to present information to the superintendent or school board to request a policy change. The school nurse may need to work with school administrators in developing guidelines that address the issue of supplement use.

Develop Content Expertise

One of the primary roles of school nurses is to be an advocate for the health and safety of children and adolescents. The school nurses should increase their personal knowledge about the use of performance-enhancing supplements in order to best protect students in their schools. The ability to provide sound empirically based information supports the school nurse's credibility regarding the issue. Additionally, it would be beneficial for the school nurse to know what products are available to students locally, by mail order, or through the Internet. The school nurse may help clarify emerging popular trends among children and adolescents regarding supplement use. Clever media messages and poorly conducted or biased research studies often just complicate the muddle of available information. Parents, students, and school personnel may be confused about what information is credible and what is not. Therefore, school nurses may want to be attuned to these trends and be a voice of reason and provide accurate, credible health information and guidance for the health and safety of those served.

CONCLUSIONS

There is no empirical evidence that supports performance-enhancing supplements as safe to use in adolescence. School nurses should not be a passive voice in this growing problem. Daily exercise programs for children and adolescents should be strongly encouraged, and a clear message against anabolic steroid use and other performance-enhancing supplementation should be given. Students, coaches, and parents should be reminded that ability comprises many factors that include genetics, body size, age, gender, and diet. Dedication and hard work are the keys to success, not a pill or powder from a bottle. Until it can be shown that supplements are safe, efforts must be made to curtail their use. The school nurse is in an excellent position to address the issue of supplement use. ■

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UPDATE

A population-based sample of 4476 students enrolled in 31 middle and high schools found that one fourth of girls and boys felt they were unable to talk with their mothers about problems. Over one half of the girls and one third of boys felt unable to talk to their fathers. Adolescents who perceived low parental caring and low parental communication about problems, and who valued their friends' opinions for serious decisions were significantly associated with unhealthy weight control, substance use, suicide attempts, body dissatisfaction, depression, and low self-esteem. Improved parent-child relationships may be an important means of preventing some high-risk behaviors in youths.

Source: Ackard DM, Neumark-Sztainer D, Story M, Perry C. Parent-child connectedness and behavioral and emotional health among adolescents. *Am J Prev Med*. 2006;30:59-66.